Redox Reactions Review

1. Identify each of the following changes as either oxidation or reduction.
   (a) $I_2 + 2e^- \rightarrow 2I^-$
   (b) $K \rightarrow K^+ + e^-$
   (c) $Fe^{2+} \rightarrow Fe^{3+} + e^-$
   (d) $Ag^+ + e^- \rightarrow Ag$

2. Identify what is oxidized and what is reduced in the following processes.
   (a) $2Br- + Cl_2 \rightarrow Br_2 + 2Cl^-$
   (b) $2Ce + 3Cu^{2+} \rightarrow 3Cu + 2Ce^{3+}$
   (c) $2Zn + O_2 \rightarrow 2ZnO$

3. Identify the oxidizing agent and the reducing agent in each of the following reactions.
   (a) $Mg + I_2 \rightarrow MgI_2$
   (b) $2Na + 2H^+ \rightarrow 2Na^+ + H_2$
   (c) $H_2S + Cl_2 \rightarrow S + 2HCl$

4. Determine the oxidation number of the underlined element in the following formulas for compounds.
   (a) $Na\underline{Cl}O_4$
   (b) $Al\underline{P}O_4$
   (c) $H\underline{N}O_2$

5. Determine the oxidation number of the underlined element in the following formulas for ions.
   (a) $\underline{N}H_4^+$
   (b) $\underline{As}O_4^{3-}$
   (c) $\underline{Cr}O_4^{2-}$

6. Determine the oxidation number of the underlined element in these compounds.
   (a) $\underline{Sb}_2O_5$
   (b) $H\underline{N}O_3$
   (c) $Ca\underline{N}_2$
   (d) $Cu\underline{W}O_4$ (copper(II) tungstate)

7. Determine the oxidation number of the underlined element in these ions.
   (a) $\underline{I}O_4^-$
   (b) $\underline{Mn}O_4^-$
   (c) $\underline{B}_4O_7^{2-}$
   (d) $\underline{N}H_2^-$

8. Use the oxidation-number method to balance these redox equations.
   (a) $HCl + HNO_3 \rightarrow HOCl + NO + H_2O$
   (b) $SnCl_4 + Fe \rightarrow SnCl_2 + FeCl_3$
   (c) $NH_3(g) + NO_2(g) \rightarrow N_2(g) + H_2O(l)$

9. Use the oxidation-number method to balance the following net ionic redox reactions.
   (a) $H_2S(g) + NO_3^-(aq) \rightarrow S(s) + NO(g)$ (in acid solution)
   (b) $Cr_2O_7^{2-}(aq) + I^-(aq) \rightarrow Cr^{3+}(aq) + I_2(s)$ (in acid solution)
   (c) $I^-(aq) + MnO_4(aq) \rightarrow I_2(s) + MnO_2(s)$ (in basic solution)

10. Balance these equations for redox reactions by using the oxidation-number method.
   (a) $HClO_3(aq) \rightarrow ClO_2(g) + HClO_4(aq) + H_2O(l)$
   (b) $H_2O_2(aq) + H_2SO_4(aq) + FeSO_4(aq) \rightarrow Fe_2(SO_4)_3(aq) + H_2O(l)$
   (c) $H_2SeO_3(aq) + HClO_3(aq) \rightarrow H_2SeO_4(aq) + Cl_2(g) + H_2O(l)$

11. Balance these net ionic equations for redox reactions.
   (a) $Cr_2O_7^{2-}$ (aq) + $Fe^{2+(}$aq) $\rightarrow Cr^{3+}(aq) + Fe^{3+}(aq)$ (in acid solution)
   (b) $Zn(s) + V_2O_5(aq) \rightarrow Zn^{2+}(aq) + V_2O_4(aq)$ (in acid solution)
   (c) $N_2O(g) + ClO^-(aq) \rightarrow Cl^-(aq) + NO_2^-(aq)$ (in basic solution)

12. Identify the species oxidized and the species reduced in each of these redox reactions.
   (a) $3Br_2 + 2Ga \rightarrow 2GaBr_3$
   (b) $HCl + Zn \rightarrow ZnCl_2 + H_2$
   (c) $Mg + N_2 \rightarrow Mg_3N_2$

13. Identify the oxidizing agent and the reducing agent in each of these redox reactions.
   (a) $H_2S + Cl_2 \rightarrow 2HCl + S$
   (b) $N_2 + 3H_2 \rightarrow 2NH_3$
   (c) $2Na + I_2 \rightarrow 2NaI$

14. Determine the oxidation number of the underlined element in these substances and ions.
   (a) $Ca\underline{Cr}O_4$
   (b) $NaH\underline{S}O_4$
   (c) $\underline{N}O_2^-$
   (d) $\underline{Br}O_3^-$

15. Determine the oxidation number of nitrogen in each of these molecules or ions.
   (a) NH_3
   (b) KCN
   (c) N_2H_4
   (d) NO_3^-
   (e) N_2O
   (f) NF_3

16. Determine the oxidation number of each element these compounds or ions.
   (a) $FeCr_2O_4$ (iron(II) chromite)
   (b) $Au_2(SeO_4)_3$ (gold(III) selenate)
   (c) $Ni(CN)_2$ (nickel(II) cyanide)

17. Use the oxidation-number method to balance these redox equations.
   (a) $CO + I_2O_5 \rightarrow I_2 + CO_2$
   (b) $Cl_2 + NaOH \rightarrow NaCl + HOCl$
   (c) $SO_2 + Br_2 + H_2O \rightarrow HBr + H_2SO_4$
   (d) $HBrO_3 \rightarrow Br_2 + H_2O + O_2$

18. Use the oxidation-number method to balance the following ionic redox equations.
   (a) $Al + I_2 \rightarrow Al^{3+} + I^-$
   (b) $MnO_2 + Br^- \rightarrow Mn^{2+} + Br_2$ (in acid solution)
   (c) $Cu + NO_3^- \rightarrow Cu^{2+} + NO$ (in acid solution)
   (d) $Zn + NO_3^- \rightarrow Zn^{2+} + NO_2$ (in acid solution)

19. Use the oxidation-number method to balance these redox equations.
   (a) $PbS + O_2 \rightarrow PbO + SO_2$
   (b) $NaWO_3 + NaOH + O_2 \rightarrow NaWO_4 + H_2O$
   (c) $NH_3 + CuO \rightarrow Cu + N_2 + H_2O$
   (d) $Al_2O_3 + C + Cl_2 \rightarrow AlCl_3 + CO$

20. Use the oxidation-number method to balance these ionic redox equations.
   (a) $MoCl_5 + S^{2-} \rightarrow MoS_2 + Cl^- + S$
   (b) $Al + OH^- + H_2O \rightarrow H_2 + AlO_2^-$
   (c) $TiCl_6^{2-} + Zn \rightarrow Ti^{3+} + Cl^- + Zn^{2+}$